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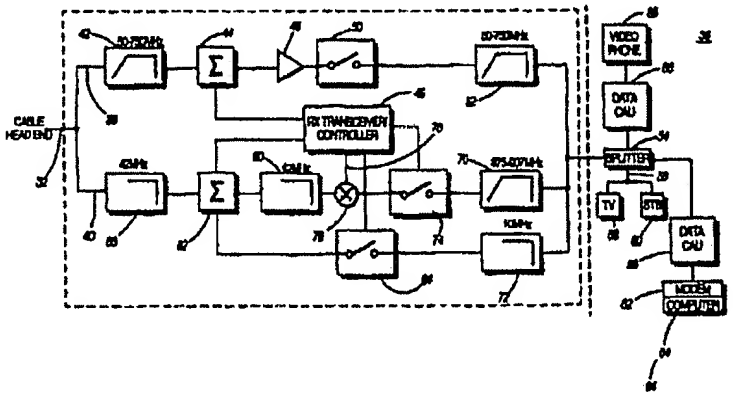
(54) Title: METHOD AND SYSTEM FOR CLEARING A FREQUENCY BAND



(57) Abstract

A cable system (10) has a plurality of CAUs (34) coupled to a variety of network devices (58-68) in the subscriber's premise (36). The network devices (58-68) transmit signals to the CAU (34) in a clear frequency (100). The signals are coupled to a filter (70) which blocks any ingress noise from the premise (36). The filter (70) is coupled to a mixer (76), which down converts the signals from the clear frequency (100) to a desired frequency (104). Upstream signals in a bypass band (102) are coupled from the network devices to a low pass filter (72). The signals are then combined with the downconverted signals and transmitted into the cable system (10).

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METHOD AND SYSTEM FOR CLEARING A FREQUENCY BAND

Field of the Invention

The present invention relates generally to the field of communications and more particularly to a method and system for clearing a desired frequency band.

Background of the Invention

Local communication networks are being designed for a wide variety of services, from telephony and broadcast television to set-top boxes, videophones and information services such as the internet. Providing these new services results in a new set of challenges to telephone and cable companies. Cable companies will have to design systems that can provide two way communication. While telephone companies will have to design a system which can simultaneously handle a variety of broadband signals.

Most likely these new services will all be provided through a single coaxial cable to the subscriber's premise. Inside the subscriber's premise a splitter will fan out a number of cable lines to the various devices needing connection to the cable system. The subscriber will be responsible for cabling within his premise, which will require a variety of splitters, connectors and couplers. Each splitter, connector and coupler is a potential source for ingress noise into the cable system. Any damage to the cable's shielding is another potential source for ingress noise.

Present, CATV systems have allocated the 5-42 MHz band for upstream signals (i.e., signals originating from the subscriber's premises). In this frequency band a wide variety of noise source exist.

These include CB radios, low frequency police radios, and electromechanical devices, such as mixers. As a result, there exists an ingress noise concern for local communications networks providing a wide variety of interactive services.

One solution is to require high quality cabling within the user' s premises. If all the connections were tight all the time and used high quality connectors and all unused terminals were terminated and there was no damage to the cables shielding, this would be an effective solution. However, traditionally the cabling within the subscriber's premise belongs to the subscriber and therefor it is difficult to monitor the quality and condition of the cabling.

A typical solution to noise problems in a communication system is to filter out the noise using frequency selective filters. However, this only works if the noise is in a different frequency band than the desired signal and in this case the likely noise sources are in the same frequency band as the desired signal. Thus there exists a need for a system and method to clear the desired frequency band of ingress noise before transmission of the desired signals.

Brief Description of the Drawings

FIG. 1 is a block diagram of a cable communication system;

FIG. 2 is a block diagram of a cable access unit and premise network device; and

FIG. 3 is a schematic diagram of a frequency allocation scheme.

Detailed Description of the Drawings

In summary the invention provides a system and method for clearing ingress noise from a desired frequency band used for transmission of signals in a communication system. The invention accepts signals in a first frequency band different from the desired frequency band. Next, the noise energy in the desired frequency band is blocked. Last, the signals are converted from the first frequency band to the desired frequency band.

FIG. 1 shows a cable communication system 10 that could advantageously use the invention of this application. At the headend 12 of the communication system 10 broadcast television signals 14, telephone and data signals 16 and video on demand (VOD) signals 18 are coupled to a combiner/splitter 20. A cable control unit (CCU) 22 provides data and telephony capability to the communication system 10 and access to a PSTN 24. A video on demand (VOD) system 26 controls and originates the video services for the subscribers of the communication system 10. The signals 28 from the combiner/splitter 20 are carried by a fiber optic cable to a fiber/coax converter 30. From the fiber/coax converter 30 the signals are carried by a coaxial cable 32 to a plurality of cable access units (CAUs) 34. The CAUs 34 are attached to the outside of a subscriber's premise 36. The CAUs 34 couple to a wide variety of information devices in the premises 36, such as televisions, telephones, computers via modems, utility management devices, wireless data ports and set-top boxes.

Present cable communication systems have allocated the 5-42 MHz frequency band (5-55 MHz in Europe) for upstream signal (i.e., signals from the subscriber's premise to the headend). As state earlier, this frequency band contains a large number of potential noise sources such as CBs, low frequency police radios, and electromechanical devices like, mixers and shavers. These noise sources are coupled into the cable communication system 10 through lose connections and broken shields in the cable in the subscriber's premise 36. This noise that is coupled into the communication system 10 is called ingress noise.

FIG. 2 shows a cable access unit 34 employing the system for clearing the upstream frequency band of ingress noise before transmitting of upstream signals. Once the coaxial cable 32, from the cable headend 12, enters the CAU 34 it is split into downstream signals 38 and upstream signals 40. A filter 42 is connected to the downstream signals 38 and filters out any out of band noise. The filter 42 is coupled to a splitter 44, that divides the downstream signal energy between a transceiver/controller 46 and a power amplifier 48. The transceiver/controller 46 receives and sends control information to the CCU 22. The power amplifier 48 is connected to a switch 50, that is

controlled by the transceiver/controller 46. The switch 50 is connected to a filter 52, that in turn connects to a power splitter 54 in the subscriber's premise 36. The power splitter 54 is connected by a coaxial cable 56 to wide variety of information network devices, such as a television 58, a set-top box 60, a modem 62 connected to a computer 64, and a video phone 66. Other devices (not shown) which might be connected to the power splitter 54, include utility management devices which read and report the amount of gas or electricity used and wireless data ports.

Except for the television 58, all the other devices are interactive, which means they not only receive signals they transmit signals upstream. These interactive network device 62, 66 may be coupled to a data CAU 68. One function of the data CAU 68 is convert the upstream signals to a clear frequency spectrum 100, see FIG. 3. The upstream signals are transmitted over one of two frequency bands, either the clear frequency spectrum 100, or a bypass band 102. In the preferred embodiment, the clear frequency spectrum is from 875 to 907 MHz and the bypass band is from 5 to 10 MHz. The upstream band 104 in the cable system 10 is allocated the 5-42 MHz band and a downstream band 106 is allocated the 50-750 MHz band.

The upstream signal energy is split and filtered by either a clear frequency filter 70 or by a low pass filter 72. The clear frequency filter 70 is then connected to a switch 74, that is controlled by the transceiver/controller 46. The switch 74 is connected to a mixer (downconverter, frequency shifter) 76, that mixes the signal with a signal 78 from a local oscillator (LO) from the transceiver/controller 46. The mixer 76 is connected to a low pass filter 80 and then to a summer 82. The low pass filter 72 is connected to a switch 84 controlled by the transceiver/controller 46 and then to the summer 82. From the summer 82 the upstream signals pass through a filter 86 and to m cable headend 12 via coaxial cable 32.

The process of clearing a desired frequency band 104 of ingress noise involves transmitting the upstream information in a clear frequency band 100. The 875-907 MHz band is selected in the preferred embodiment because there are few noise sources in this frequency band

at the typical subscriber's premise 36. The upstream information is then filtered so that the energy in the desired frequency band 104 is block from entering the cable communication system 10 from the premise 36. The upstream information in the clear frequency band 100 is then frequency shifted 76 to the desired frequency band 104 for transmission over the coaxial cable 32.

The controllable switches 74 and 84 are used by the system to physically block noise if a noise source or network device 62, 66 continuously emits noise into the cable system 10. The CCU 22 would detect this upstream noise source and signal the appropriate CAU 34 to open either switch 74 or 84.

While the invention is described with respect to the problem of ingress noise in a cable system, the invention has applications beyond this problem. For instance, the invention could be used to clear a frequency channel in a long distance telephone cable. For those skilled in the art many other alternatives, modifications and variations will be obvious. For instances, the invention could be implemented without the bypass band. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the appended claims.

Claims

What is claimed is:

1. A system for clearing a desired frequency band for transmission in a communication system susceptible to ingress noise in an uplink frequency spectrum, comprising:

a conductor, coupled to an access unit, the conductor transmitting information to the access unit in a clear frequency spectrum;

a filter in the access unit, coupled to the conductor, rejecting all but the clear frequency spectrum; and

a frequency converter, coupled to the filter and shifting the information from the clear frequency spectrum to the uplink frequency spectrum.

2. The system of claim 1, wherein the filter passes both a selected bypass band as well as the clear frequency spectrum.

3. A system for clearing a desired frequency band for transmission in a cable communication system susceptible to noise in a preferred frequency spectrum, comprising:

a filter coupled to a network device that transmits information in a clear frequency spectrum, the filter rejecting a corrupted spectrum different from the clear frequency spectrum; and

a frequency shifter, coupled to the filter and shifting the information from the clear frequency spectrum to the preferred frequency spectrum suitable for transmission on the cable communication system.

4. The system of claim 3, wherein the filter passes a selected bypass band as well as the clear frequency.

5. A method for clearing a desired frequency band for transmission in a cable communication system, comprising the steps of:

accepting energy in a first frequency band and the desired frequency band, the desired frequency band being different from the first frequency band, including accepting signals in the first frequency band;

blocking the energy in the desired frequency band; and

frequency shifting the signals in the first frequency band to the desired frequency band.

6. A system for clearing a desired frequency band for transmission in a cable-based communication system, comprising:

a cable, coupled to a cable access unit, the cable transmitting information in an clear frequency spectrum;

a filter, coupled to the cable, rejecting all but the clear frequency spectrum;

a downconverter, coupled to the filter and shifting the information from the clear frequency spectrum to an uplink frequency spectrum; and

a switch between the filter and the downconverter.

7. A system for clearing a desired frequency band for transmission in a cable-based communication system, comprising:

a cable, coupled to a cable access unit, the cable transmitting information in an clear frequency spectrum;

a filter, coupled to the cable, passing only a selected bypass band and the clear frequency spectrum; and

a downconverter, coupled to the filter and shifting only the information from the clear frequency spectrum to an uplink frequency spectrum.

8. A system for clearing a desired frequency band for transmission in a cable communication system, comprising:

a filter, coupled to a network device that transmits information in a clear frequency spectrum and a signal contained in a selected bypass band, the filter passing the clear frequency spectrum and the selected bypass band and rejecting a corrupted spectrum;

a frequency shifter, coupled to the filter and shifting the information from the clear frequency spectrum to a preferred frequency spectrum; and

a switch controlled by the cable communication system, the switch being located between the filter and the frequency shifter.

9. A method for reducing ingress noise in an uplink transmission of a cable-based communication system comprising the steps of:

a network device transmitting to a cable access unit information in a clear frequency band;

receiving at the cable access unit the information in the clear frequency band along with energy in an uplink frequency band;

filtering out the energy in the uplink frequency band received at the cable access unit;

frequency shifting the information in the clear frequency band to the uplink frequency band;

transmitting the uplink frequency band on the cable-based communication system.

10. A system for reducing ingress noise in an uplink transmission of a communication system comprising:

a network device transmitting information in a clear frequency band;

a filter in an access unit receiving the information in the clear frequency band, the filter passing the clear frequency band and blocking an uplink frequency band; and

a first frequency converter converting the information in the clear frequency band to the uplink frequency band.

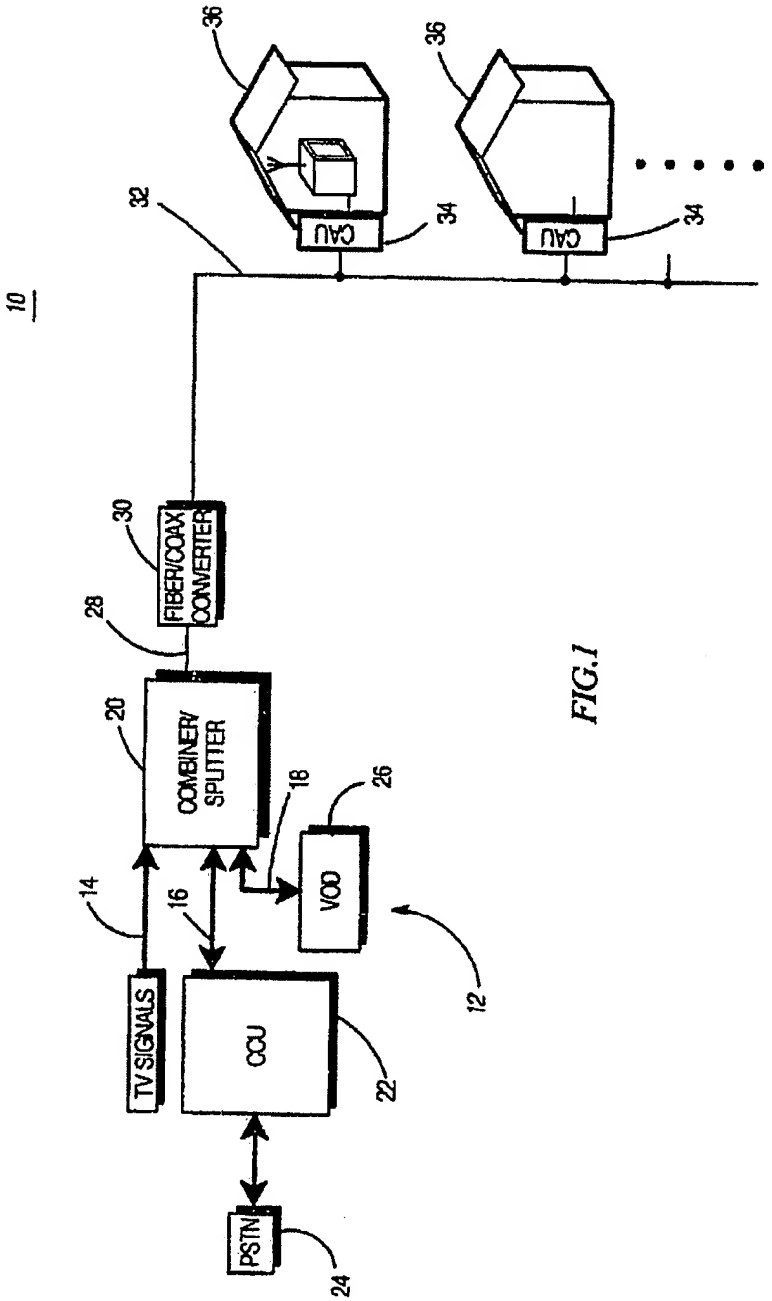
36
36
32
34
34
CAU
CAU
10
30
FIBER/COAX CONVERTER
28
20
COMBINER/ SPLITTER
18
26
VOD
14
16
12
TV SIGNALS
CCU
22
PSTN
24

FIG.1

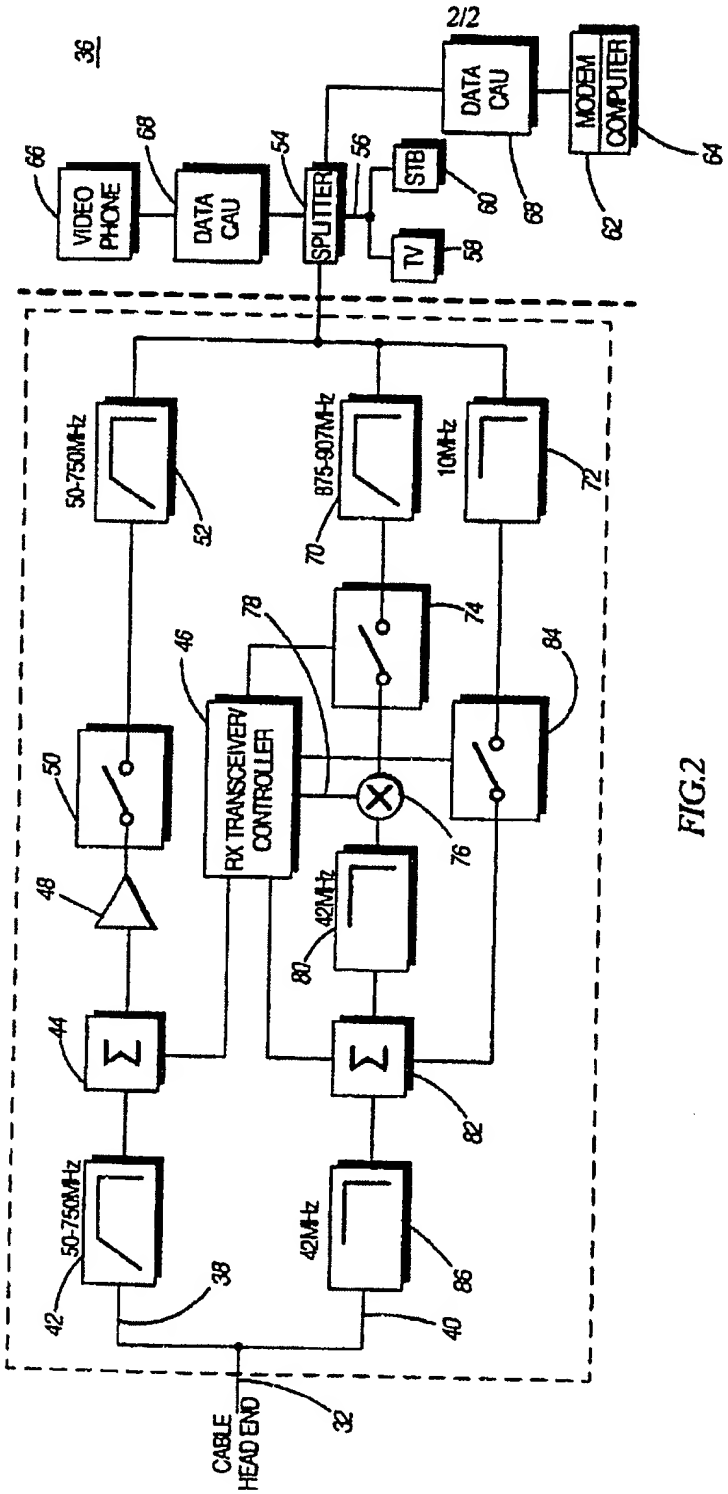
36
66
VIDEO PHONE
68
DATA CAU
54
SPLITTER
56
STB
60
TV
58
DATA CAU
68
MODEM COMPUTER
62
64
50-750MHz
52
875-907MHz
70
10MHz
72
78
74
46
84
RX TRANSCEIVER/ CONTROLLER
50
76
48
42MHz
80
44
82
50-750MHz
42
38
42MHz
86
40
CABLE HEAD END
32

FIG.2

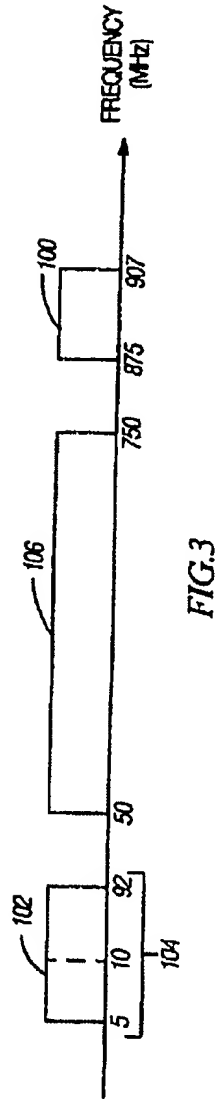
FREQUENCY (MHz)
100
907
875
750
106
50
92
102
10
104
5

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/17063

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : H04K 1/02; H04L 25/03, 25/49
US CL :375/296
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 375/296; 348/6,8,10,11; 455/3.1,4.1,4.2,6.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Dialog
search terms:cable, ingress noise, downconverter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,771,456 (MARTIN ET AL.) 13 September 1988 (See figure 1, summary, col.3,line 58 to col.4,line 53).	1-10
A	US, A, 4,553,264 (HASEGAWA ET AL.) 12 November 1985, abstract and summary of the invention.	1-10
A	US, A, 5,355,162 (YAZOLINO ET AL.) 11 October 1994, abstract and summary of the invention.	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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